

Original Article

Impact of Delivery Mode on Breastfeeding Practices: A Prospective Cohort Study

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ABSTRACT

Background: Breastfeeding is crucial for infant health, providing optimal nutrition and immunity. The mode of delivery significantly influences breastfeeding practices, with Normal Vaginal Delivery (NVD) often enabling earlier initiation and exclusivity than Lower Segment Cesarean Section (LSCS). This study examines differences in breastfeeding initiation, exclusivity, and associated challenges between NVD and LSCS mothers at a tertiary healthcare facility. **Methods:** A prospective observational study was conducted at Government Medical College (GMC) Jalaun over seven months, including 623 mothers (320 NVD, 303 LSCS). Data were collected using a questionnaire on breastfeeding initiation, breastfeeding practices, and challenges at six weeks, 14 weeks, and six months postpartum. **Results:** Early breastfeeding initiation (in 1st hour) was significantly higher among NVD mothers (81.88%) compared to LSCS mothers (9.24%) ($p < 0.01$). LSCS mothers exhibited higher pre-lacteal feeding rates (73.60% vs. 12.19%) and reported more breastfeeding challenges, such as latching difficulties (42.24% vs. 24.06%) and low milk supply (43.23% vs. 22.81%) ($p < 0.01$). Exclusive breastfeeding rates remained consistently higher among NVD mothers across all follow-up points, with significant differences at six weeks, 14 weeks, and six months. **Conclusions:** The mode of delivery significantly impacts breastfeeding practices, with LSCS presenting greater challenges to early initiation and exclusivity. Tailored breastfeeding support for LSCS mothers, including immediate skin-to-skin contact and early lactation consultations, may help bridge these gaps, ultimately enhancing maternal and infant health outcomes.

Key words: Breastfeeding practices, Cesarean section, Vaginal delivery, Exclusive breastfeeding, Maternal health

Breastfeeding is essential for infant health, delivering optimal nutrition, immune support, and fostering a mother-infant bond that reduces infant morbidity and mortality globally [1]. The World Health Organization (WHO) and UNICEF recommend exclusive breastfeeding for the first six months, emphasizing initiation within the first hour post-birth to enhance health outcomes and lower neonatal mortality [2, 3]. Early initiation of breastfeeding also promotes maternal health by aiding uterine involution and reducing the risk of postpartum hemorrhage [4]. The mode of delivery significantly affects breastfeeding practices. Normal Vaginal Delivery (NVD) usually enables immediate skin-to-skin contact, facilitating timely breastfeeding initiation [5]. In contrast, Lower Segment Cesarean Section (LSCS) often delays initiation due to factors like postoperative pain, anesthesia effects, and limited maternal mobility [6]. Studies show that around 70% of NVD mothers initiate breastfeeding within the

first hour, compared to approximately 27% of LSCS mothers [7]. By the third day postpartum, successful breastfeeding is established in about 86% of NVD cases versus only 40% in LSCS cases [8].

LSCS is also linked to increased prelacteal feeding and lower exclusive breastfeeding rates during the first six months [9]. Understanding the influence of delivery mode on breastfeeding is essential as cesarean rates rise globally, with implications for maternal and child health [10]. Cultural factors further shape breastfeeding practices. Societal norms, traditions, and beliefs can either support or hinder breastfeeding initiation and duration. In certain cultures, prelacteal feeding is common, potentially delaying breastfeeding initiation [11]. Social support, maternal education, and cultural attitudes towards breastfeeding impact a mother's behavior to initiate and continue breastfeeding [12, 13]. For example, mothers who perceive strong community support are more likely to practice exclusive breastfeeding [13].

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This study aims to compare breastfeeding practices including initiation, duration, and exclusivity between NVD and LSCS mothers at 6 weeks, 14 weeks and 6 months postpartum.

METHODS

This prospective observational study was conducted at Government Medical College (GMC) Jalaun, a tertiary healthcare facility in the Bundelkhand region. The design was chosen to allow observation of breastfeeding practices over time among mothers who underwent Normal Vaginal Delivery (NVD) and those who had Lower Segment Cesarean Section (LSCS). Data collection took place from June 2023 to January 2024, spanning a seven-month period. The sample size was determined through a power analysis, aiming to detect significant differences in breastfeeding initiation and exclusive breastfeeding rates between NVD and LSCS groups. The analysis used an 80% power, a 95% confidence level, and an estimated effect size based on prior studies [14, 15], targeting a total of 600 participants to ensure adequate power and representativeness, with approximately 300 participants in each group.

The study population included all mothers who delivered at GMC Jalaun during the specified period and met the inclusion criteria. Out of 961 deliveries (619 NVDs and 342 LSCSs), 303 LSCS mothers were selected based on inclusion and exclusion criteria. For the NVD group, systematic random sampling was employed, selecting every second eligible NVD mother until the sample size of 320 was achieved. This approach was used to balance representation between groups. The study's inclusion criteria consisted of mothers who had either NVD or LSCS at GMC Jalaun, delivered a single healthy neonate at 37 weeks or more of gestation, and provided informed consent. Exclusion criteria included complicated deliveries requiring ICU/NICU admission, preterm deliveries (gestation <37 weeks), multiple gestations, and mothers with contraindications to breastfeeding (e.g., active tuberculosis, HIV).

To reduce potential bias, data collectors were trained in standardized interviewing techniques and data entry protocols before the study commenced. Data accuracy was ensured through daily double-checking of entries. Though complete blinding was not feasible, interviewer bias was minimized by using a structured questionnaire with neutral questioning techniques. Interviews were conducted privately to promote participant comfort and minimize response bias. Data were collected using a pre-validated questionnaire developed in collaboration with experts in Pediatrics and Obstetrics & Gynecology at GMC Jalaun. The questionnaire covered demographic information, breastfeeding initiation timing, challenges faced (such as latching difficulties, milk supply, and nipple pain), and follow-up feeding patterns at six weeks, 14 weeks, and six months postpartum. Interviews were conducted

face-to-face during the postpartum hospital stay by trained healthcare professionals, with breastfeeding practices assessed via maternal self-report and corroborated with medical records when available. Follow-up assessments were conducted through scheduled in-person visits or phone calls, with appointment reminders via phone and text to minimize loss to follow-up.

The questionnaire was pilot-tested on a sample of 40 mothers not included in the study population, leading to minor adjustments for clarity. Content validity was verified by expert review from pediatricians, obstetricians, and public health specialists, ensuring relevance and comprehensiveness. Ethical approval was granted by the Institutional Ethics Committee (IEC) of GMC Jalaun, and all included participants provided informed consent. Consent forms were provided in both Hindi and English, with explanations given as needed to ensure comprehension. Privacy concerns, particularly for participants with varying literacy levels, were addressed by having trained staff verbally explain the study details.

Data Analysis

Data were analyzed using statistical software Jamovi version 2.3.28. Descriptive statistics summarized demographic and clinical characteristics. Independent-sample t-tests were used for continuous variables, while Chi-square test was used for categorical comparisons. Tables and charts were prepared using Microsoft Excel web version.

RESULTS

In total, 623 mothers participated in the study, comprising 320 who had Normal Vaginal Deliveries (NVD) and 303 who underwent Lower Segment Cesarean Sections (LSCS). The mean maternal age was slightly higher in the LSCS group (25.2 ± 4.01 years) compared to the NVD group (24.3 ± 3.69 years), with a statistically significant difference ($p = 0.004$). The age distribution revealed that a greater proportion of NVD mothers were below 20 years (11.56% vs. 8.25%), while LSCS mothers were more likely to fall within the 30-35 years range (7.59% vs. 3.75%). Parity also varied between groups; primiparous mothers were more common in the LSCS group (47.85% vs. 41.25%), while multiparous mothers were more prevalent among NVD participants (58.75% vs. 52.15%). Socioeconomic status, occupation, and education were similar across both groups ($p > 0.05$). LSCS newborns had a higher mean birth weight (2.76 ± 0.382 kg) compared to NVD newborns (2.66 ± 0.358 kg), with a significant difference ($p < 0.001$). Additionally, the mean gestational age was longer for LSCS infants (39.8 ± 0.822 weeks) compared to NVD infants (39.3 ± 0.770 weeks) ($p < 0.001$). Gender distribution did not significantly differ between groups, with similar proportions of male infants in both the NVD (53.75%) and LSCS (57.10%) deliveries (table 1).

Table 1: Demographics

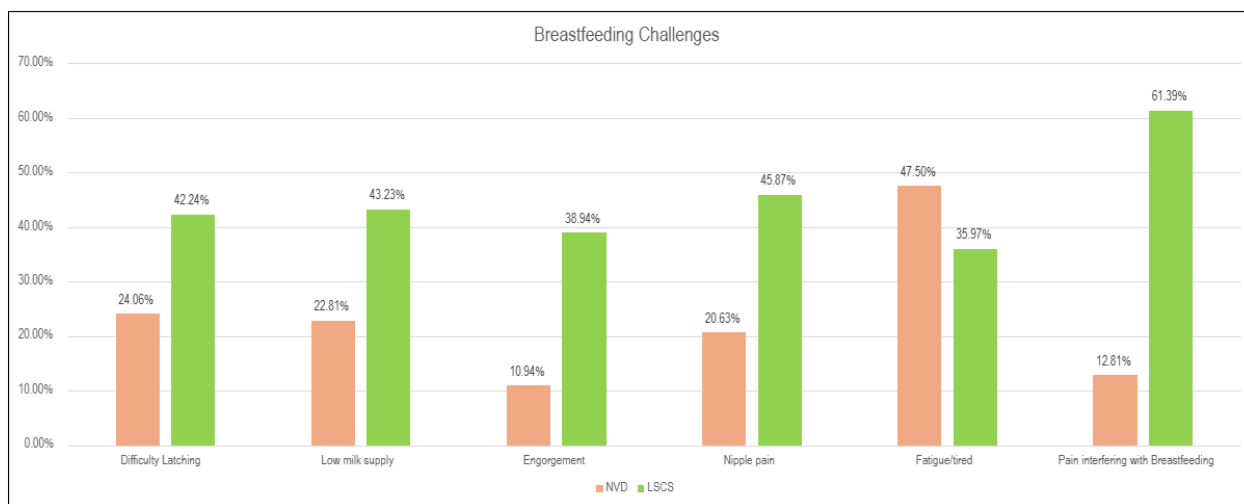
	NVD (n=320)	LSCS(n=303)	p-value
Age (mean±SD)	24.3±3.69	25.2±4.01	0.004
Age Group			
-<20 yr	11.56% (37)	8.25% (25)	0.033
-20-25 yr	52.50% (168)	47.19% (143)	
-25-30 yr	32.19% (103)	35.97% (109)	
-30-35 yr	3.75% (12)	7.59% (23)	
- >35 yr	0.00% (0)	0.99% (3)	
Parity			
-Primiparous	41.25% (132)	47.85% (145)	0.097
-Multiparous	58.75% (188)	52.15% (158)	
Occupation			
-Housewife	46.88% (150)	50.50% (153)	0.366
-Working	53.13% (170)	49.50% (150)	
Socioeconomic status			
-Lower Class	1.25% (4)	2.31% (7)	0.372
-Upper Lower	39.06% (125)	38.94% (118)	
-Lower Middle	45.94% (147)	42.57% (129)	
-Upper Middle	12.50% (40)	15.84% (48)	
-Upper Class	1.25% (4)	0.33% (1)	
Education			
-Illiterate	11.25% (36)	12.54% (38)	0.727
-Primary School	19.69% (63)	16.83% (51)	
-Middle School	19.38% (62)	21.45% (65)	
-High School	23.13% (74)	23.10% (70)	
-Intermediate	17.19% (55)	18.48% (56)	
-Graduate	5.31% (17)	5.31% (17)	
-Postgraduate & above	4.06% (13)	1.98% (6)	
Marital Status			
-Married	99.38% (318)	99.66% (302)	0.622
-Widow/Divorced	0.31% (1)	0.33% (1)	
-Single	0.31% (1)	0.00% (0)	
Gestational age (mean±SD)	39.3±0.770	39.8±0.822	<0.001
Birthweight (mean±SD)	2.66±0.358	2.76±0.382	<0.001
Sex of baby			
-Female	46.25% (148)	42.90% (130)	0.401
-Male	53.75% (172)	57.10% (173)	

Significant differences were observed in breastfeeding initiation and early practices between the NVD and LSCS groups (Table 2). Breastfeeding within the first hour was much higher among NVD mothers (81.88%) compared to LSCS mothers (9.24%), with a significant p-value (< 0.01). Similarly, the rate of skin-to-skin contact within the first hour was greater in the NVD group (89.06%) than in the LSCS group (15.84%) ($p < 0.01$). The mean time to initiate breastfeeding was significantly shorter for NVD mothers (54.9 ± 24.1 minutes) compared to LSCS mothers (339 ± 168 minutes) ($p < 0.01$). Prelacteal feeding practices were more prevalent among LSCS mothers (73.60%) than among NVD mothers (12.19%) ($p < 0.01$). At discharge, exclusive breastfeeding rates were higher in the NVD group (93.13%) relative to the LSCS group (82.18%) ($p < 0.01$).

Table 2: Breastfeeding Initiation

	NVD (n=320)	LSCS(n=303)	p-value
Skin to skin contact within 1hr			
-Yes	89.06% (285)	15.84% (48)	<0.01
-No	10.94% (35)	84.16% (255)	
Breastfeeding initiation in 1 hr			
-Yes	81.88% (262)	9.24% (28)	<0.01
-No	18.13% (58)	90.76% (275)	
Time to initiate Breastfeeding			
-Minutes	54.9±24.1 min	339±168 min	<0.01
-Hours	0.92±0.40 hrs	5.65±2.8 hrs	
Prelacteal feeding			
-Yes	12.19% (39)	73.60% (223)	<0.01
-No	87.81% (281)	26.40% (80)	
Hospital stay (days)			
	2.72±0.7	6.69±0.55	<0.01
Exclusive Breastfeeding at discharge			
-Yes	93.13% (298)	82.18% (249)	<0.01
-No	6.88% (22)	17.82% (54)	

This data was collected 24 to 36 hours after delivery. Mothers in the LSCS group reported significantly more breastfeeding challenges than those in the NVD group. Difficulty latching was reported by 42.24% of LSCS mothers compared to 24.06% of NVD mothers ($p < 0.01$). Low milk supply affected 43.23% of LSCS mothers, whereas 22.81% of NVD mothers reported similar issues ($p < 0.01$). Other common challenges among LSCS mothers included breast engorgement (38.94% vs. 10.94% in NVD, $p < 0.01$) and nipple pain (45.87% vs. 20.63% in NVD, $p < 0.01$). Pain that interfered with breastfeeding was reported by 61.39% of LSCS mothers, significantly higher than the 12.81% reported by NVD mothers, highlighting the impact of postoperative recovery on breastfeeding initiation and sustainability.

**Figure 1 – Breastfeeding challenges**

Exclusive breastfeeding rates remained higher in the NVD group throughout the follow-up period. At six weeks postpartum, 82.50% of NVD mothers were exclusively breastfeeding, compared to 60.73% of LSCS mothers ($p < 0.01$). This trend continued at 14 weeks, with 66.56% of NVD mothers breastfeeding exclusively versus 30.03% of LSCS mothers ($p < 0.01$). By six months, exclusive breastfeeding rates were still higher in the NVD group (60.63%) compared to the LSCS group (20.13%) ($p < 0.01$). LSCS mothers were more likely to use formula milk gradually shifting to animal milk over time. Feeding frequency trends also varied between groups; at six weeks, more NVD mothers fed their infants over eight times daily (44.06% vs. 33.99%, $p < 0.01$). Although feeding frequency differences remained at 14 weeks, they had largely diminished by six months.

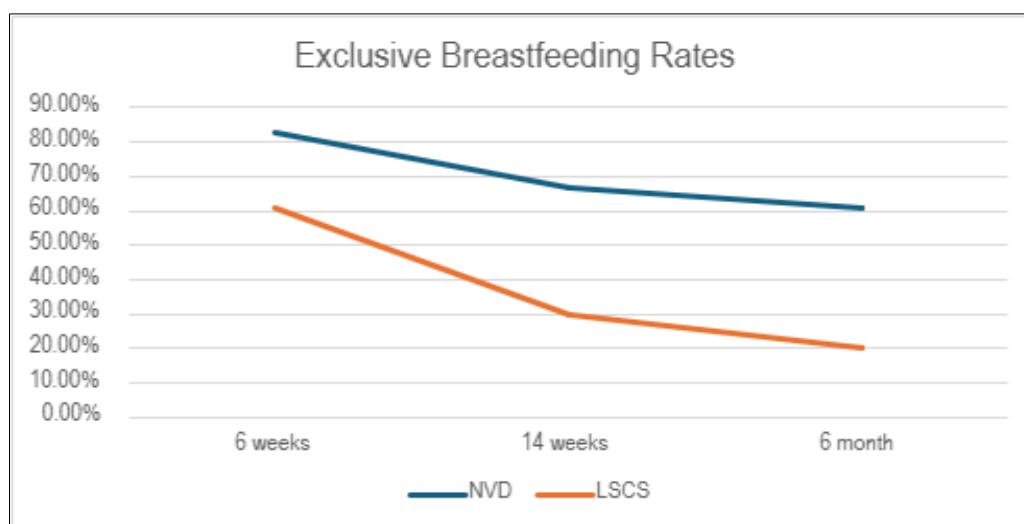


Figure 2 – Exclusive breastfeeding rates at different time periods

Table 3: Breastfeeding Challenges

	NVD (n=320)	LSCS(n=303)	p-value
Difficulty Latching			
-Yes	24.06% (77)	42.24% (128)	<0.01
-No	75.94% (243)	57.76% (175)	
Low milk supply			
-Yes	22.81% (73)	43.23% (131)	<0.01
-No	77.19% (247)	56.77% (172)	
Engorgement			
-Yes	10.94% (35)	38.94% (118)	<0.01
-No	89.06% (285)	61.06% (185)	
Nipple pain			
-Yes	20.63% (66)	45.87% (139)	<0.01
-No	79.38% (254)	54.13% (164)	
Fatigue/tired			
-Yes	47.50% (152)	35.97% (109)	0.004
-No	52.50% (168)	64.03% (194)	
Pain interfering with Breastfeeding			
-Yes	12.81% (41)	61.39% (186)	<0.01
-No	87.19% (279)	38.61% (117)	

Table 4: Follow up 6 weeks

	NVD (n=320)	LSCS(n=303)	p-value
Feeding type			
-Exclusive Breastfeed	82.50% (264)	60.73% (184)	<0.01
-Breast+Animal milk	4.69% (15)	5.94% (18)	
-Breast+Formula milk	3.13% (10)	20.79% (63)	
-Breastmilk+Other	1.88% (6)	0.99% (3)	
-Animal milk only	3.13% (10)	2.97% (9)	
-Formula milk only	2.50% (8)	5.61% (17)	
-Lost to follow up/ Not alive	2.19% (7)	2.97% (9)	
Feeding frequency			
-<5 times/day	14.38% (46)	13.53% (41)	0.044
-5 to 8 times/day	39.38% (126)	49.50% (150)	
->8 times/day	44.06% (141)	33.99% (103)	
-Lost to follow up/ Not alive	2.19% (7)	2.97% (9)	

Table 5: Follow up 14 weeks

	NVD (n=320)	LSCS(n=303)	p-value
Feeding type			
-Exclusive Breastfeed	66.56% (213)	30.03% (91)	<0.01
-Breast+Animal milk	15.00% (48)	42.24% (128)	
-Breast+Formula milk	3.13% (10)	9.90% (30)	
-Breastmilk+Other	2.19% (7)	0.99% (3)	
-Animal milk only	7.81% (25)	9.57% (29)	
-Formula milk only	1.56% (5)	3.30% (10)	
-Lost to follow up/ Not alive	3.75% (12)	3.96% (12)	
Feeding frequency			
-<5 times/day	20.00% (64)	23.43% (71)	0.763
-5 to 8 times/day	63.44% (203)	60.07% (182)	
->8 times/day	12.81% (41)	12.54% (38)	
-Lost to follow up/ Not alive	3.75% (12)	3.96% (12)	

Table 6: Follow up 6 month

	NVD (n=320)	LSCS(n=303)	p-value
Feeding type			
-Exclusive Breastfeed	60.63% (194)	20.13% (61)	<0.01
-Breast+Animal milk	16.25% (52)	46.53% (141)	
-Breast+Formula milk	2.19% (7)	8.91% (27)	
-Breastmilk+Other	3.13% (10)	1.98% (6)	
-Animal milk only	12.19% (39)	14.19% (43)	
-Formula milk only	0.31% (1)	2.97% (9)	
-Lost to follow up/ Not alive	5.31% (17)	5.28% (16)	
Feeding frequency			
-<5 times/day	46.25% (148)	44.22% (134)	0.964
-5 to 8 times/day	37.50% (120)	39.27% (119)	
->8 times/day	10.94% (35)	11.22% (34)	
-Lost to follow up/ Not alive	5.31% (17)	5.28% (16)	

DISCUSSION

This study explored breastfeeding practices among mothers who underwent Normal Vaginal Delivery (NVD) and Lower Segment Cesarean Section (LSCS) in a tertiary healthcare setting. Our findings revealed distinct differences in breastfeeding initiation, exclusivity, and challenges based on the mode of delivery. These findings align with existing literature, reinforcing known barriers while also offering insights specific to our setting. We observed a significantly higher rate of early breastfeeding initiation within the first hour among NVD mothers (81.88%) compared to LSCS mothers (9.24%). This disparity aligns with prior studies that suggest cesarean deliveries often delay breastfeeding initiation due to factors like anesthesia effects, postoperative pain, and limited mobility [14, 15]. Emam and Ali [15] demonstrated similar

challenges among cesarean mothers, attributing delays to the need for pain management and restricted maternal movement. In our setting, skin-to-skin contact within the first hour was considerably lower among LSCS mothers (15.84%) than NVD mothers (89.06%), further impeding early breastfeeding initiation. Immediate skin-to-skin contact is critical for breastfeeding initiation, even for cesarean deliveries, as highlighted by Moore *et al.* [5], who found that early mother-infant contact supports successful breastfeeding initiation despite the delivery mode.

Institutional factors, such as extended recovery room stays for LSCS mothers, contribute to delays in breastfeeding initiation. This prolonged separation from the infant after LSCS limits early breastfeeding opportunities. Studies by Nguyen *et al.* [16] suggest that introducing protocols for immediate skin-

to-skin contact post-LSCS could improve early breastfeeding rates, as seen in facilities where this practice has been implemented successfully. Such protocols could be adapted to our context to address the low rates of early breastfeeding initiation among cesarean mothers.

Prelacteal feeding practices were markedly more common among LSCS mothers (73.60%) than NVD mothers (12.19%). This pattern is consistent with findings by Wu *et al.* [17] and Kiani *et al.* [18], who reported that delayed breastfeeding initiation and maternal discomfort often lead to higher rates of prelacteal feeding among cesarean mothers. Prelacteal feeding is known to interfere with exclusive breastfeeding, as it disrupts the establishment of breastfeeding routines and reduces the likelihood of sustained breastfeeding [17]. Counseling to discourage prelacteal feeding among LSCS mothers could be beneficial, as suggested by studies that highlight the negative impact of this practice on exclusive breastfeeding rates [19].

Our study further showed that exclusive breastfeeding rates remained consistently higher among NVD mothers throughout the follow-up period. Exclusive breastfeeding declined over time in both groups but was persistently higher among NVD mothers at all follow-up points: six weeks (82.50% vs. 60.73%), 14 weeks (66.56% vs. 30.03%), and six months (60.63% vs. 20.13%). These trends are similar to those reported by Beake *et al.* [19], who noted that cesarean mothers experience issues such as delayed milk production and positioning difficulties, which can hinder exclusive breastfeeding. Patel *et al.* [22] recommend providing targeted lactation consultations to support exclusive breastfeeding among LSCS mothers, which could help address these challenges in our setting as well.

Our findings revealed that LSCS mothers faced more breastfeeding difficulties than NVD mothers, including significant challenges with latching (42.24%), low milk supply (43.23%), and breast engorgement (38.94%). These results are consistent with studies by Zhang *et al.* [20] and Taha *et al.* [21], who documented that cesarean mothers often encounter greater obstacles in establishing successful breastfeeding compared to vaginally delivered mothers. These challenges may be linked to surgical recovery factors, which limit maternal mobility and contribute to difficulties in breastfeeding. Chen *et al.* [22] advocate for breastfeeding-friendly hospital policies that offer early lactation support to reduce these barriers, which could be adapted to our healthcare context. Routine lactation consultations within the first 24 hours post-LSCS have been associated with a significant increase in exclusive breastfeeding rates, as evidenced by Patel *et al.* [23], highlighting the benefit of immediate and accessible support for LSCS mothers.

Our results emphasize the need for tailored breastfeeding support for LSCS mothers. Practical measures could include:

1. Enhanced lactation consultations by dedicated counselors within 24 hours post-LSCS.

2. Implementing effective pain management strategies to improve breastfeeding comfort.
3. Training healthcare staff to facilitate early skin-to-skin contact after cesarean deliveries.
4. Integrating breastfeeding-friendly policies into standard hospital care protocols.

Our findings align with broader literature indicating that cesarean delivery is often associated with delays in breastfeeding initiation and lower exclusivity rates. Prior *et al.*'s meta-analysis [6] supports our results, showing that cesarean deliveries are less conducive to early breastfeeding initiation and sustaining exclusivity. However, most of the existing literature predominantly examines high-income countries, while our study contributes valuable data from a lower-resource setting. This highlights the universality of these challenges across healthcare contexts. The success of tailored interventions in mitigating the adverse impact of LSCS on breastfeeding, as demonstrated in other studies, underscores the potential benefits of adopting similar strategies in our setting [15, 16].

This study has several limitations. It was conducted at a single tertiary healthcare facility, which may limit the generalizability of the findings to other settings. Additionally, reliance on self-reported data introduces a possibility of recall bias; however, we minimized this risk by prospectively collecting data and cross-verifying with medical records. Some confounding factors, such as maternal education, cultural beliefs, and socioeconomic status, were not fully controlled for, which could have influenced breastfeeding outcomes. Future studies should incorporate these variables to provide a more comprehensive understanding of breastfeeding practices across varied settings.

Future research should consider multicenter studies (including both private and government hospitals) to enhance the generalizability of findings. Randomized controlled trials evaluating specific interventions, such as early lactation consultations and kangaroo care, would provide robust evidence on improving breastfeeding outcomes among LSCS mothers. Additionally, exploring psychosocial factors, such as family support and maternal self-efficacy, could yield insights into improving breastfeeding success for cesarean mothers [24]. Innovative approaches, such as mobile health interventions, may also offer accessible lactation support, especially in low-resource settings.

Authors Contributions

CJ and MG conceptualized and designed the protocols for the study under the supervision of GSC. JT, and HM played the main roles in data collection. HM digitized the data, performed statistical analysis and prepared the initial drafts of the study. CJ and MG critically reviewed and edited the manuscript. The manuscript was finalized by GSC.

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